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Glacial lakes in the Indian Himalayas--from an area-wide glacial lake inventory to on-site and modeling based risk assessment of critical glacial lakes.

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Abstract

Glacial lake hazards and glacial lake distributions are investigated in many glaciated regions of the world, but comparably little attention has been given to these topics in the Indian Himalayas. In this study we present a first area-wide glacial lake inventory, including a qualitative classification at 251 glacial lakes >0.01 km(2). Lakes were detected in the five states spanning the Indian Himalayas, and lake distribution pattern and lake characteristics were found to differ significantly between regions. Three glacial lakes, from different geographic and climatic regions within the Indian Himalayas were then selected for a detailed risk assessment. Lake outburst probability, potential outburst magnitudes and associated damage were evaluated on the basis of high-resolution satellite imagery, field assessments and through the use of a dynamic model. The glacial lakes analyzed in the states of Jammu and Kashmir and Himachal Pradesh were found to present moderate risks to downstream villages, whereas the lake in Sikkim severely threatens downstream locations. At the study site in Sikkim, a dam breach could trigger drainage of ca. 16×10(6)m(3) water and generate maximum lake discharge of nearly 7000 m(3) s(-). The identification of critical glacial lakes in the Indian Himalayas and the detailed risk assessments at three specific sites allow prioritizing further investigations and help in the definition of risk reduction actions.

KEYWORDS: BASEMENT; Glacial lake inventory; Glacial lake outburst flood (GLOF); Indian Himalayas; Risk assessment; Scenario modeling

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